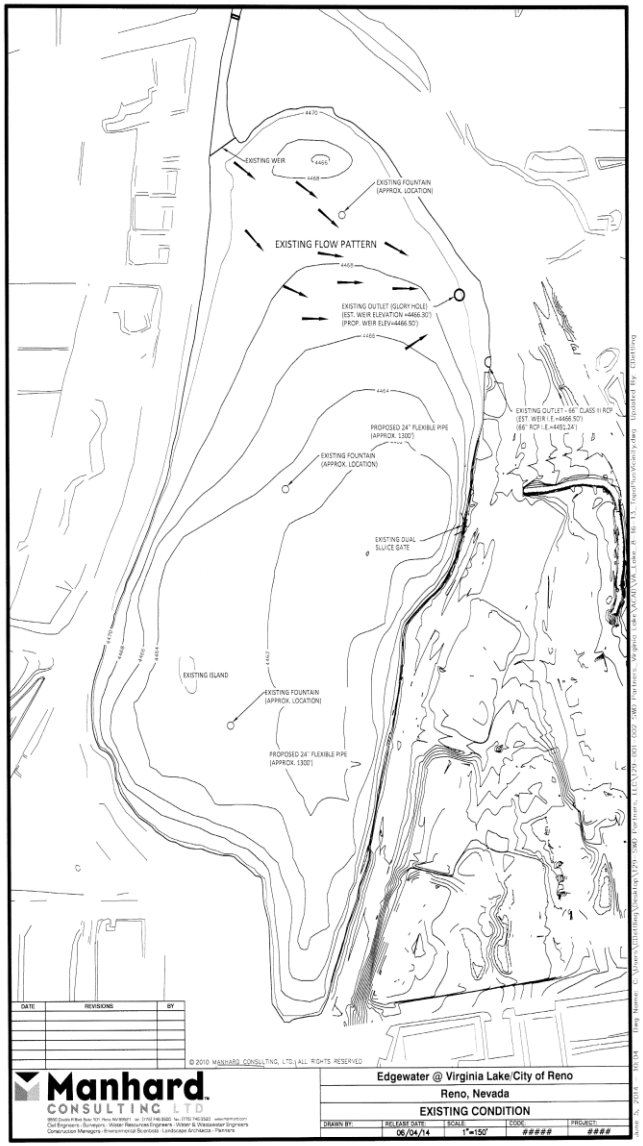
VIRGINIA LAKE WATER QUALITY IMPROVEMENT PROJECT

September 18, 2014

Virginia Lake Flows and Topography

Virginia Lake is 29 acres, has a capacity of 208 acre/feet and a maximum depth of 12 feet.
Water enters through the Cochran Ditch, and the Plumas/Moana storm drain system at the south end.
Water exits the park through the “Glory Hole” and the Southside Storm Drain, draining downstream to Boynton Slough and Steamboat Creek, where it heads north into the Truckee River.



While providing habitat, Virginia Lake collects storm drainage from 4.3 square miles of urban area, and is operated as a dam by the City of Reno.

History on Virginia Lake

Virginia Lake was lined in 1939, funded by the Works Progress Administration. It included a fish hatchery at the dog park site until 1965 flood event. There have been water quality issues recorded on the lake since 1980s.

Maintenance has included:
Three fountains installed in 2002, including new electrical drop ($55,000); Repairs including a new motor in 2007 ($4700); Repairs with two new motors in 2011 and 2013 ($7000 and $1700);

Fountains installed as result of avian botulism outbreaks in 2000 & 2001 (good water years but over 120 waterfowl mortalities each season (nearly 3x that in 2014).

Virginia Lake Renovation Plan commenced in 2004, per Reno City Council. The Plan identified issues with the island, and water quality improvements are an ongoing part of park renovation. Lab testing reported high pH and P leading to algae blooms.

Shoreline improvements (Southwest Corner, East point, and East shoreline) were completed in 2004 ($330,000), 2007 ($380,000) and 2010 ($325,000). The Glory hole was rebuilt in 2010 ($73,000).

Investigation: Water Quality

- 2014. Data gathered, from water, soil, algae.
- Continuous and grab samples measuring fluctuations in the lake.

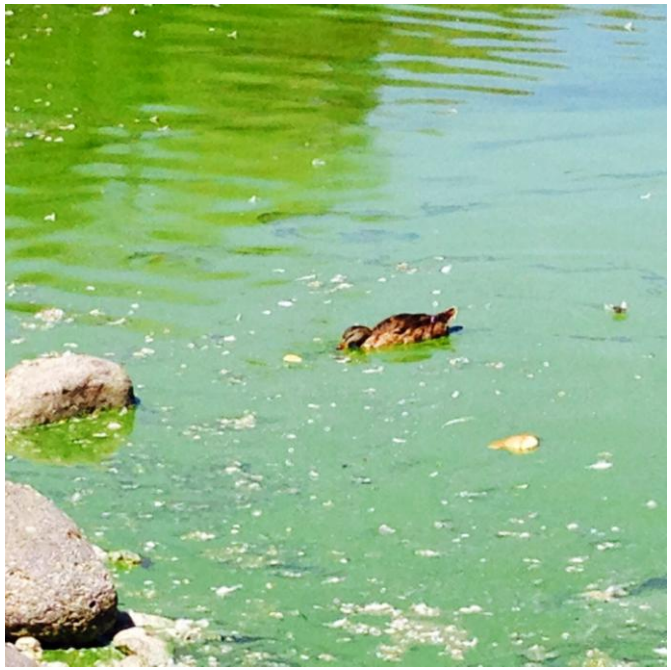
Issue: Poor Water Quality

Several factors have negatively impacted the water quality at Virginia Lake.

- Drought conditions;
- Shallow water with sunlight reaching bottom of lake;
- High phosphorus levels in water and constant input by overpopulation of resident birds;
- Extensive blue-green algae bloom further impacting the system.

Strong Indicator: Blue-green algae

- Blue-green algae thrives in water high in nutrients with ample sunlight.
- The blue-green algae bloom depletes oxygen levels, creating toxic conditions and toxic bacteria dangerous to fish, birds and mammals.



High Phosphorus

High levels of phosphorus in water is a result of:

- Overcrowded, dense population of waterfowl on the island.
  - Can reach upwards of 400 waterfowl during nesting.
- Waterfowl's piscivorous (fish rich) diets = extremely high phosphorus waste.
  - Excretion takes place primarily at night while resting.

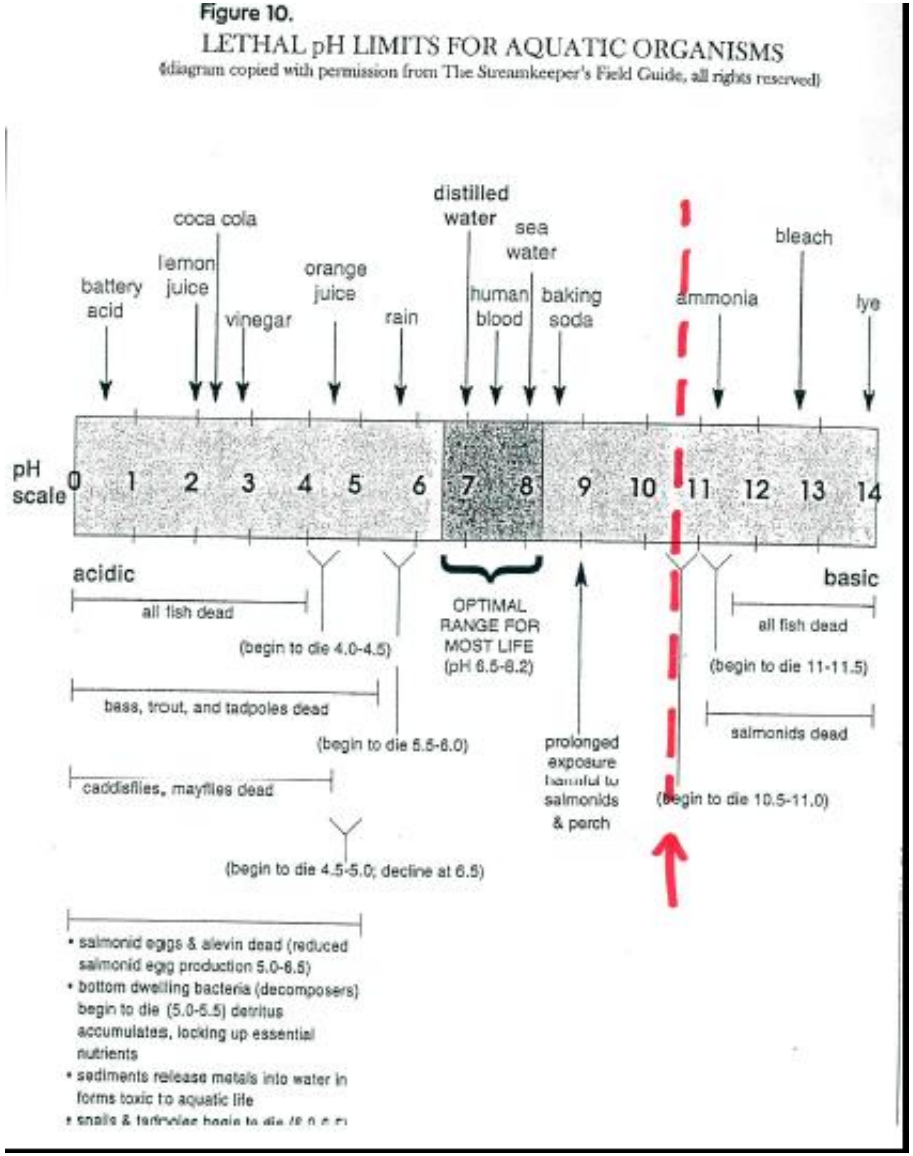
These factors stimulate blue-green algae blooms.

Confounding factors and concerns

- Nearby golf courses use fertilizers at various times of year which may run off into lake.
  - Staff investigations have shown nearby golf courses do not use formulations with high phosphorus in their maintenance activities.

- Bird feeding by residents provide human foods to birds (not a healthy diet) and create an overpopulation of birds at Virginia Lake.
  - Reno Municipal Code Compliance –
    - **Sec. 8.23.175. Feeding of waterfowl, birds and wildlife prohibited.**

All life falls into a delicate balance



Unhealthy water quality affects wildlife

Phosphorus and Nitrogen grow algae. High nutrients = Thick algae.
Ratios of Nitrogen to Phosphorus are an indicator of the health of waters.

Algae creates oxygen during the day, and sucks it up during the night. This creates a toxic condition for wildlife in the water, as the oxygen values swing up and down nearly 100% every day. This gives aquatic organisms the bends.

Trout need higher levels of oxygen than warm water fishes. However, when oxygen levels dip so low, Carp can be seen coming up to gulp air at the surface.

Water Quality Standards and Total Maximum Daily Load (TMDL) are regulations on the Truckee River downstream, and include Total Phosphorus.

Phosphorus and Nitrogen grows algae

- Algae needs nitrogen and phosphorus both to bloom.
- Algae pulls nitrogen from the air (Anabaena), making it an unlimited nutrient.
- Phosphorus levels are extremely high in the lake. We have on Virginia Lake right now, 0.85-0.96 mg/L total phosphorus.
- Comparatively, lower Steamboat Creek has a Water Quality Standard for Total Phosphorus. This value is 0.33 mg/L, as set by the Nevada Department of Environmental Protection (in the Nevada Administrative Code).
- With this high phosphorus: We have a runaway train for blue green algae blooms.

Solutions to Water Quality issue

- Aeration alone will not eradicate blue green algae.
- Deepening the lake is not an option.
- The City believes that removal of the single largest point source of phosphorus is the key.
- The foundation to a healthy ecosystem in this setting is water quality.

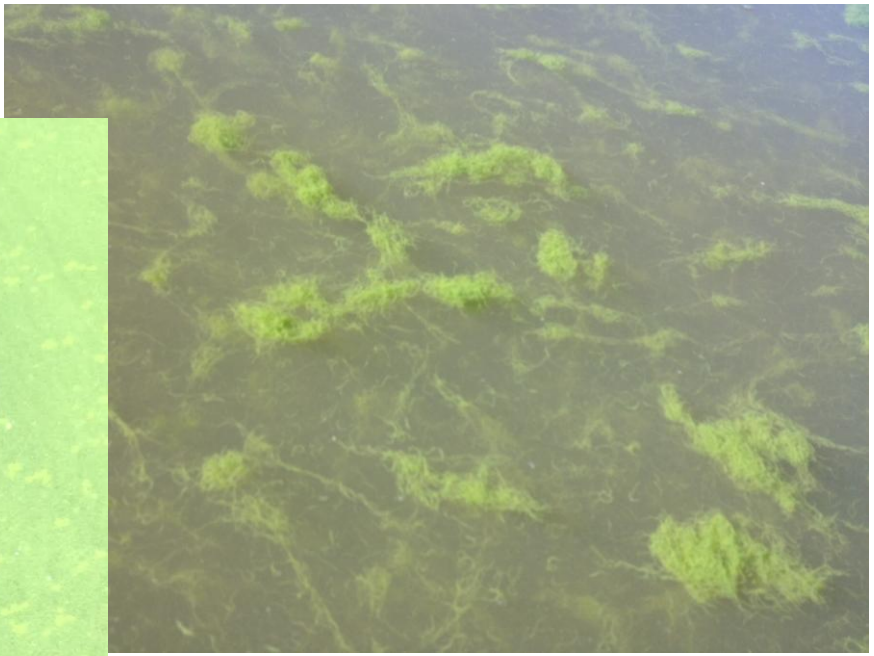
Removal of phosphorus source: Phase 1

Removal of the island at Virginia Lake and Public Education

- Removal of the island prevents roosting for dense populations of Cormorants and gulls, reducing negative impacts to the water quality.
- Improving the water quality in Virginia Lake provides a healthier habitat for a wider variety of birds, fish and mammals.
- Permitting is currently underway and construction on Phase 1 is expected to begin this fall.
- Public outreach and education has begun and will continue, sharing storm water pollution prevention ideas and watershed connectivity.

Changing conditions and results are positive

- Cold weather will reduce algae blooms. We may see a re-bloom with warm fall temps, low water levels, and high phosphorus.
- Low phosphorus in sediments means island removal **will** provide a relief to algal blooms, perhaps even next summer.



Circulation system Phase 2

Design and circulation of water in Virginia Lake

- Staff is working on designing a system to improve water circulation in Virginia Lake. Various ideas:
  - Moving the outlet structure to the south end of the lake (Passive);
  - Seasonal diffuser system use to generate aeration once flow from Truckee River ends.

- Design for Phase 2 will be accomplished in Spring, 2015.

- Staff will be pursuing funding for Phase 2; one source has currently been identified.

Outreach: Storm Water pollution mitigation

- KTMB, a partner with the Truckee Meadows Watershed Committee agencies, leads Truckee River Cleanup Day for storm drain stenciling activities at 8am on September 27, 2014.

- 80 volunteers will gather in neighborhoods draining to Virginia Lake and provide service for the morning, stenciling storm drains and educating neighbors about storm drain pollution.

- Truckee River is Downstream of Virginia Lake: Only Rain in the Storm Drain. Please take a handout to understand how to lessen your contribution to nutrient pollution.

Partners

Project partners include:

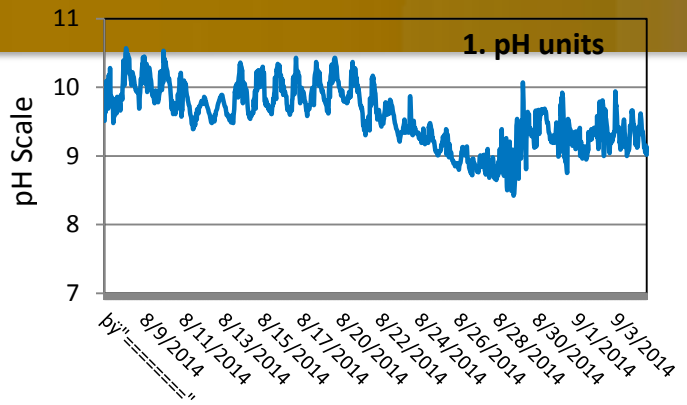
- City of Reno;
- Nevada Department of Wildlife;
- Truckee River Fund (Truckee Meadows Water Authority ratepayers source);
- Reno-Tahoe International Airport Authority;
- Keep Truckee Meadows Beautiful (KTMB);
- Silverwing Development (Phase 2);
- U.S. Fish & Wildlife Service (USFWS).

Public Meeting

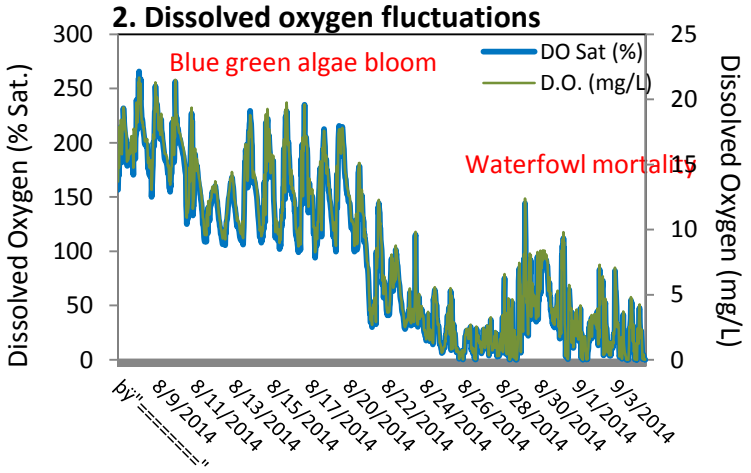
Thank you.

For information and updates on the
Virginia Lake Water Quality Improvement Project
please visit Reno.gov

Virginia Lake Water Quality 2014



1. pH is Out of balance at values of 9.0-10.5.
   - EPA recommended range is 6.5-9.0
   - Likely this is caused by profound eutrophication, with excessive nutrients causing disruption of the lake's carbonic acid cycle.
   - Comparative grab sample values: 6/10/14: pH is 7.47 and 7/25/14: pH is 8.42.



2. Tremendous Dissolved oxygen fluctuations on a daily basis stress aquatic life. Regulators of surface waters, such as the Nevada Division of Environmental Protection, sets Water Quality Standards based on the "% Oxygen" in waters, but the amount of fluctuation daily is what really impacts the biota. Steamboat Creek standard for D.O. is 3.0 mg/L. Comparative values from grab samples, 6/10/14: DO is 5.5 mg/L /62.3% saturated and 7/25/14: DO is 7.5 mg/L /87.6% saturated.

3. Nutrients. Values of phosphorus are excessively high and promote blue-green algae growth. As a comparison, the Nevada Division of Environmental Protection, sets Water Quality Standards based on beneficial uses in waters. Phosphorus standards on lower Steamboat Creek is set at 0.33 mg/L. Upstream waters must be "protective" of this standard, as a tributary.